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Career-long and COVID-19-specific citation impact of highly visible COVID-19 media experts

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Career-long and COVID-19-specific citation impact of highly visible COVID-19 media experts

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ABSTRACT

Objective: To evaluate whether the COVID-19 experts who appear most frequently in media have high citation impact for their research overall, and for their COVID-19 peer-reviewed publications in particular and to examine the representation of women among such experts.

Design: Cross-linking of datasets of most highly visible COVID-19 media experts with citation data on the impact of their published work (career-long publication record and COVID-19-specific work).

Setting: Cable news appearance in primetime programming or overall media appearances.

Participants: Most highly visible COVID-19 media experts in US, Switzerland, Greece, and Denmark

Interventions: none

Outcome measures: Citation data from Scopus along with discipline-specific ranks of overall career-long and COVID-19-specific impact based on a previously validated composite citation indicator.

Results: We assessed 76 COVID-19 experts who were highly visible in US primetime cable news, and 50, 12, and 2 highly visible experts in media in Denmark, Greece, and Switzerland, respectively. Of those, 23/76, 10/50, 2/12, and 0/2 were among the top-2% of career-long citation impact among scientists in the same discipline worldwide. Moreover, only 34/76, 11/50, 5/12, and 2/2 had published anything on COVID-19 that was indexed in Scopus as of March 1, 2021. Therefore, 63% of COVID-19 experts who appeared massively in news media had not published anything on COVID-19 in the Scopus-indexed scientific literature by that time. Only 18/76, 6/50, 2/12, and 0/2 of the highly visible COVID-19 media experts were women. 55 scientists in the USA, 5 in Denmark, 64 in Greece, and 56 in Switzerland had a higher citation impact for their COVID-19 work than any of the evaluated highly visible media COVID-19 experts in the respective country; 10/55, 2/5, 22/64, and 14/56 of them were women.

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Conclusions: Despite notable exceptions, there is a worrisome disconnect between COVID-19 claimed media expertise and scholarship. Highly-cited women COVID-19 experts are rarely included among highly visible media experts.

ARTICLE SUMMARY

Strengths and limitations of this study

- We examined the citation impact in the scientific literature of highly visible COVID-19 media experts in four different countries (USA, Denmark, Greece, and Switzerland)

- We also examined whether these highly visible media experts had published anything on COVID-19

- We identified women experts who have contributed with high impact in the COVID-19 literature but have not been among these highly visible media experts

- The findings need to be extrapolated cautiously in other countries and other media (e.g. social media)

- Most scientists may not wish to be visible in media, but the disconnect between COVID-19 claimed media expertise and scholarship is worrisome.

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INTRODUCTION

The COVID-19 pandemic has been accompanied by an unprecedented infodemic in the news and social media.[1,2] Media coverage has been intensive, continuous, massive, and heated and has involved a very large number of alleged experts. The involvement of knowledgeable scholars in the public discussion and dissemination of information on such a monumental crisis is clearly welcome and indispensable. However, how knowledgeable are the experts recruited by media?

Knowledge and expertise is difficult to appraise with full objectivity. However, what can be readily appraised in a non-subjective fashion is the publication and citation track record of scientists who appear in news media as experts. One can use objective data to quantify the citation impact of the published work of these scientists across science throughout their career, as well as the specific impact that they are having with their scientific publications about COVID-19. Here we aimed to evaluate the overall and COVID-19 specific citation impact of the most highly visible COVID-19 experts in USA, Denmark, Greece, and Switzerland. We also paid particular attention to probing the representation of women among highly visible COVID-19 experts, as it has been previously suggested that women are under-represented among COVID-19 experts in the USA.[3]

METHODS

Highly visible media COVID-19 experts

For the USA, we examined the scientific citation impact of all scientists who had appeared between May 18 to June 19, 2020 during primetime programming on 3 popular American cable news networks: Fox News Network, CNN, and MSNBC. The features of the assessed sample have been previously described.[3] Of the 220 people who appeared during these programs, 76 were scientists (47 physicians and 29 PhDs).

We also probed highly visible media COVID-19 experts in Denmark, Greece, and Switzerland.

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For Denmark, we found a news article that listed the 50 experts who had the highest number of appearances in media during 2020 (television, radio, newspapers).[4] For Greece, we found a news article that listed the 12 COVID-19 experts who had the highest television exposure based on measured time of television appearances.[5] For Switzerland, the Swiss Media Database (SMD) captures appearances in media in Switzerland. We could find information from a news article[6] on the two most commonly appearing names of COVID-19 experts in SMD between md-January and June 2020.

Citation databases for career-long impact of scientific work and COVID-19-specific work

For career-long impact of scientific work, we used a previously developed, publicly available dataset[7] that includes the top 2% of scientists across each of the 174 disciplines of science (classified according to the Science Metrix classification).[7] All ~8 million scientists who have published at least 5 Scopus-indexed full papers (counting articles, reviews, and conference papers) are considered. The ranking uses a previously developed and validated composite citation indicator[8] that merges 6 citation metrics (total citations, Hirsch h index, co-authorship-adjusted Schreiber Hm index, citations to single-authored papers, citations to first- or single-authored papers, and citations to single-, first- or last-authored papers).

We also examined which of the evaluated highly visible COVID-19 experts had published anything pertaining to COVID-19 in the scientific literature. We used a previously created database[9] that includes all the authors with at least 5 Scopus-indexed full papers in their career (on any topic) who had also published at least one Scopus-indexed item on COVID-19 (peer-reviewed or preprint) as of March 1, 2021. Details on the search strategy and retrieval of authors can be found in the paper describing the compilation of that database.[9] In brief, the search string was: TITLE-ABS-KEY(sars-cov-2 OR "coronavirus 2" OR "corona virus 2" OR covid-19 OR {novel coronavirus} OR {novel corona virus} OR 2019-ncov OR covid OR covid19 OR ncovid-19 OR "coronavirus disease 2019" OR "corona virus disease 2019" OR corona-19 OR SARS-nCoV OR ncov-2019) with items limited to a publication date in 2020 or 2021. We have previously[9]

generated the same composite citation indicator (that includes the 6 citation metrics described above)

limited to the citation impact of COVID-19 publications for each author. We therefore noted how many of

the highly visible COVID-19 experts were among the top-2000 or top-10000 ranked scientists for the

citation impact of their COVID-19 publications as of March 1, 2021.

We tabulated the experts who are in the top-2% of citation impact for their career-long published

work and concurrently are among the top-2% based on the citation impact of their COVID-19 published

work in their primary scientific disciplines among other scientists with the same primary scientific

discipline.

We also noted how many of the highly visible media COVID-19 experts were women in each

country; how many scientists in each country had a higher citation impact for their COVID-19 published

work than all the highly visible media COVID-19 experts in the respective country; and how many of these

scientists with higher citation impact for their COVID-19 published work were women.

All citation metrics and rankings thereof exclude all self-citations.

RESULTS

Experts in the USA

Of the 76 highly visible cable news COVID-19 expert scientists, only 18 were women. Only 23 of

the 76 were in the top 2% of their main scientific discipline in terms of their citation impact during their

careers until the end of 2019. The main disciplines of these 23 top-cited experts' previous scientific work

was General and Internal Medicine (n=7), Economics (n=2), Health Policy and Services (n=2),

Microbiology (n=2), Public Health (n=2), and 8 other disciplines (1 each). 13 appeared on MSNBC, 9 on

CNN, and 1 on Fox News. Only 3 of the 23 were women.

Only 34 of the 76 COVID-19 scientists had published anything that was COVID-19-related even 9

months after they appeared as COVID-19 experts in these major media. Using the same composite citation

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indicator focused specifically on the citation impact of their COVID-19 work, only 7 were among the top-2000 scientists world-wide for COVID-19-related citation impact and 18 were among the top-10000 scientists worldwide in this regard. 19 appeared on MSNBC, 13 on CNN, and 2 on Fox News. Nine of the 34 were women.

Experts in Denmark

For Denmark, only 6 of the 50 top media experts were women. The most frequently appearing expert was Søren Brostrøm, director of the National Board of Health (9324 mentions, about 25 per day). 48/50 were Danes and 2 were foreigners. 43/50 had commented on COVID-19, but it was not stated who are the 7 who only commented only on other, non-COVID-19-related topics. Ten of the 50 (9 Danes, 1 foreigner) were among the 2% top-cited for career-long scientific work. Only 6 of the 50 were women. A perusal of their listed scientific subfield suggested that 33/50 worked in a biomedical or potentially related field; thus, apparently, at least 10 of the experts were from other fields, which included economics or law. Among the 50, only 11 (all of them among the 33 biomedical) had published any COVID-19-related work indexed in Scopus by March 1, 2021, and of those 11 only 3 were among the top-10000 scientists worldwide for COVID-19-related citation impact (Anthony Fauci, rank 224; Thomas Benfield, rank 4461; Lone Simonsen, rank 8307). Among the 48 visible experts who were Danes, the best ranked for published COVID-19 work (Thomas Benfield) was ranked 6th in COVID-19-related impact among scientists in Denmark.

Experts in Greece

For Greece, only 2 of the 12 most visible television COVID-19 experts were women. Ten of the twelve were local and two were in the diaspora (in UK and Switzerland) but appeared massively in Greek media. Two of the 12 (Elias Mossialos and Emmanouil Dermitzakis, both in the diaspora) were among the 2% top-cited for career-long scientific work. Only 5 of the 12 had published any COVID-19-related work

indexed in Scopus by March 1, 2021, and of those only 1 was among the top-10000 scientists worldwide

for COVID-19-related citation impact (Elias Mossialos, rank 4435). Among the 10 visible experts who

were living in Greece, the best ranked for published COVID-19 work (Charalambos Gogos, worldwide

rank 10710) was ranked 65th in COVID-19-related impact among scientists in Greece.

Experts in Switzerland

The two most commonly appearing names of COVID-19 experts in SMD between mid-January and

early June 2020 were Marcel Salathé, an associate professor at the École Polytechnique Fédérale de

Lausanne, with 1400 entries in SMD during this period (as opposed to 9 entries in the entire 2019), and

Christian Althaus (an epidemiologist at the University of Bern) with approximately 700 entries. Neither of

them have been in the top-2% of the most-cited scientists for their career work across all scientific topics.

They have both published scientific work related to COVID-19. For their COVID-19-related published

work, they are ranked 58th and 57th among scientists in Switzerland (rank 3839 and 3819, respectively,

worldwide among all scientists publishing on COVID-19).

Top-cited on both on COVID-19 and during overall career

Based on our primetime US cable news sample, Table 1 shows the experts who were top-cited for

their citation impact in the scientific literature during their overall career and also specifically for their

work on COVID-19. Ezekiel Emanuel was the most highly-ranked (ranked 227th among over 495,000

scientists)[9] in global COVID-19 citation impact among our sample. There were 55 U.S. authors with higher

COVID-19 citation impact. Among those 55, some such as Bill Gates (global COVID-19 citation ranking

212th) and Anthony Fauci (global COVID-19 citation ranking 224th) have attracted substantial media

attention but simply did not appear in our primetime programming sample. E.g. there were numerous video

clippings and references to Dr. Fauci that aired on the primetime programs that we screened, but he was not

personally interviewed in the 5 weeks studied here. However, it is likely that the majority of the most

influential scientists on COVID-19 research have not appeared prominently in the lay media and many of them are probably entirely absent.

Our samples of massively visible experts from Switzerland and Greece were small, but only 1/12 visible experts (Elias Mossialos) was in the top-2% of both overall career-long and COVID-19 specific citation impact. For the Denmark sample, only Anthony Fauci (and no local Danish scientists) were in the top-2% of both COVID-19 and overall career-long citation impact.

Missing expert women with top citation impact

Among the 55 U.S. authors with higher COVID-19 citation impact than all the 76 scientists in our US cable news sample, there were 10 women. They are shown along with their affiliations and their primary and secondary disciplines of expertise in Table 2. We searched the CNN site (https://www.cnn.com/search?size=10&q=), and the Fox News site (https://www.foxnews.com/#) for videos in 2020 or 2021 up to March 14, 2021 (we found no way to search only for videos in MSNBC), i.e. covering the entire period of the pandemic and all time slots, not just primetime. We found no stored videos with the name of any of these 10 female scientists, as compared with 272 and 32400 videos, respectively, retrieved with a search for "Fauci."

In Denmark, Greece, and Switzerland, 2/5, 22/64, and 14/56 scientists with higher COVID-19 citation impact ranking than the highest ranked massively visible news experts were women. These highly-cited women scientists are shown along with their affiliations and their primary and secondary disciplines of expertise in Table 3 for Denmark and Greece. For Switzerland where we only had the 2 most visible COVID-19 experts, we could not exclude that several of the 56 scientists with higher COVID-19 citation impact ranking may also had been highly visible in the media.

DISCUSSION

The present analysis suggests that only a minority of media-visible COVID-19 experts have had major scientific citation impact in their careers. Moreover, only a minority have any scientific record of any COVID-19-related publications. Highly visible COVID-19 media experts are very rarely influential in the scientific literature overall and/or in the COVID-19 scientific literature in particular. Women are markedly under-represented among those visible experts, although additional female experts exist. We could not assess the racial background of media experts, but we suspect that minorities would also be under-represented, as they are under-represented in many aspects of both academics and societal power structures.

The lack of sufficient representation of top scientists among the most visible experts in media may not be specific to COVID-19 and may affect all topics where science is invoked in public discourse. A pre-printed analysis of experts in German media (no individual names were available) suggested that media coverage on the COVID-19 pandemic actually used experts with higher citation indicators compared to earlier pandemics.[10] Past empirical evaluations of experts on various topics has shown that many of them, typically the majority, have not done any research themselves on the topics on which they pontificate.[11-13] Concurrently, there is an increasing hunger for having more and more experts in popular media.[14,15]

We should acknowledge that citation metrics do not perfectly capture the best scientists. Moreover, the best or the most-cited scientists should not necessarily be the ones who appear the most frequently in media. Some of the experts whom we analyzed have accumulated a track record of massive media engagements that require an enormous commitment of time and psyche. Many highly competitive, excellent scientists would find it difficult or even impossible to pursue their scholarly work and have an intense media presence at the same time. Moreover, especially for COVID-19, polarization, politics, and an environment of conspiracy, mistrust, and public unrest and rage may have disincentivized many leading

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scientists from engaging with media. Women and minorities may feel even more disincentivized in this environment.

Nevertheless, communication with the wider public is an important mission of science, medicine, and public health. Information on COVID-19 in media has been shown to be of questionable quality.[1,2] Its quantity is clearly immense. The vast majority is produced and disseminated by people without any scientific training and with little or no self-reflection on their inadequacy to judge complex and rapidly evolving scientific concepts. It may be impossible to diminish the bulk of information, but at a minimum its quality should be improved. Engaging qualified experts may be critical in this regard. Of note, several of the highly visible media COVID-19 experts were probably invited in some capacity other than their research scholarship, e.g. some scientists had political or administrative roles and others were front line clinicians rather than academics. These aspects of non-research expertise are also very useful, and it could well be that all experts analyzed here should be applauded for their willingness to engage and inform the wider public. Even if they lack focused research expertise on COVID-19, certainly many practicing physicians and scientists may still elevate the discourse compared with people without any medical and scientific training. However, it is worrisome that "scientific experts" in the news include so few of the scientists who have themselves made substantial scholarly contributions.

We encourage media to look more carefully at the diversity and scholarly qualifications of the experts they invite, even more so for experts that have massive media appearances. Special attention should be given to inviting women, and our evaluation offers examples of many women scientists who might be considered in this regard. We suspect that many top experts may still wish to avoid media exposure and this should be respected. However, transparency and availability of opportunity are still important to ensure.

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Table 1. Some outstanding scientists with media presence (those of the 76 with primetime appearance in

CNN, MSNBC or Fox News in May 18 to June 19, 2020 who are at the top-2% of citation impact in their

discipline both for all their work and for their COVID-19 work)

Name	Institution	Primary discipline	Rank for COVID-19	Scientists in discipline (COVID-19 work)	Rank for all work	Scientists in discipline (all)
Grabowski, David C.	Harvard Medical School	Health Policy & Services	1	2522	90	16521
Holtgrave, David R.	University at Albany	Public Health	48	9211	385	48533
Jha, Ashish K.	Harvard University	General & Internal Medicine	397	32920	91	106795
Gawande, Atul A.	Brigham and Women's Hospital	Surgery	114	12295	58	80940
Topol, Eric	Scripps Research Translational Institute	Cardiovascular System & Hematology	28	19231	7	152312
Emanuel, Ezekiel J.	University of Pennsylvania Perelman School of Medicine	General & Internal Medicine	26	32920	31	106795
Fineberg, Harvey V.	Gordon E. and Betty I. Moore Foundation	General & Internal Medicine	158	32920	503	106795

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Risch, Harvey A.	Yale University	Oncology & Carcinogenesis	95	19550	690	230678
Hotez, Peter J.	Baylor College of Medicine	Tropical Medicine	8	4941	4	28529
Prather, Kimberly A.	Scripps Institution of Oceanography	Meteorology & Atmospheric Sciences	8	1745	830	54940
Aral, Sinan	MIT Sloan School of Management	Information Systems	91	619	163	16581

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Table 2. Women scientists with higher citation impact of their COVID-19-related published work than all

of the 76 experts who appeared in the analyzed sample of USA cable news primetime

Scientist	Institution	Primary discipline	Secondary discipline
Guarner, Jeannette	Emory University School of Medicine	Pathology	Microbiology
Bourouiba, Lydia	Massachusetts Institute of Technology	Fluids & Plasmas	Evolutionary Biology
Phelan, Alexandra L.	Georgetown Law	General & Internal Medicine	Applied Ethics
Abbasi, Jennifer	University of California, San Francisco	General & Internal Medicine	
Walls, Alexandra C.	University of Washington, Seattle	Developmental Biology	Biophysics
Connors, Jean M.	Harvard Medical School	Cardiovascular System & Hematology	Immunology
de Wit, Emmie	NIAID Rocky Mountain Laboratories	Virology	Microbiology
Volkow, Nora D.	National Institutes of Health (NIH)	Neurology & Neurosurgery	Psychiatry
Rubin, Rita	Independent journalist	General & Internal Medicine	
Amanat, Fatima	Icahn School of Medicine at Mount Sinai	Microbiology	Virology

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Table 3. Women scientists with higher citation impact of their COVID-19-related published work than all

of the 50 most visible media experts in Denmark; or than all the 12 most visible television COVID-19

experts in Greece

Scientist	Institution	Primary discipline	Secondary discipline
Vindegaard, Nina	Copenhagen University Hospital	Neurology & Neurosurgery	Psychiatry
Olsen, Sonja J.	WHO Regional Office for Europe	Microbiology	Virology
Anastassopoulou, Cleo	National and Kapodistrian University of Athens	Virology	Epidemiology
Fragkou, Paraskevi C.	Attikon University Hospital	Microbiology	Emergency & Critical Care Medicine
Goumenou, Marina	University of Crete Medical School	Food Science	Toxicology
Psaltopoulou, Theodora	National and Kapodistrian University of Athens	Oncology & Carcinogenesis	Nutrition & Dietetics
Rovina, Nikoletta	National and Kapodistrian University of Athens	Respiratory System	Immunology
Maltezou, H. C.	National Public Health Organization	Microbiology	Virology
Gavriilaki, Eleni	George Papanicolaou General Hospital	Cardiovascular System & Hematology	Immunology
Parlapani, Eleni	Aristotle University of Thessaloniki	Psychiatry	Substance Abuse
Katsaounou, Paraskevi	National and Kapodistrian University of Athens	Public Health	Respiratory System
Gavriatopoulou, Maria	National and Kapodistrian University of Athens	Immunology	Oncology & Carcinogenesis
Dalamaga, Maria	National and Kapodistrian University of Athens	Endocrinology & Metabolism	Dermatology & Venereal Diseases

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Kaparounaki, Chrysi K.	Aristotle University of Thessaloniki	Psychiatry	
Koutsoukou, Antonia	National and Kapodistrian University of Athens	Respiratory System	Emergency & Critical Care Medicine
Nikitara, Katerina	University of Crete Medical School	Public Health	Toxicology
Rizou, Myrto	Galanakis Laboratories	Obstetrics & Reproductive Medicine	Food Science
Kotanidou, Anastasia	National and Kapodistrian University of Athens	Emergency & Critical Care Medicine	Respiratory System
Kontou, Panagiota	Panepistimio Thesalias	Bioinformatics	Genetics & Heredity
Akinosoglou, Karolina	University of Patras, School of Medicine	Microbiology	Immunology
Dedeilia, Aikaterini	National and Kapodistrian University of Athens	General & Internal Medicine	Oncology & Carcinogenesis
Georgakopoulou, Eleni A.	National and Kapodistrian University of Athens	Dentistry	Dermatology & Venereal Diseases
Mpesiana, Tzani A.	Panepistimion Patron		
Katsiki, Niki	Aristotle University of Thessaloniki	Cardiovascular System & Hematology	Medicinal & Biomolecular Chemistry

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Overall and COVID-19-specific citation impact of highly visible COVID-19 media experts:

bibliometric analysis

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ABSTRACT

Objective: To evaluate whether the COVID-19 experts who appear most frequently in media have high citation impact for their research overall, and for their COVID-19 peer-reviewed publications in particular and to examine the representation of women among such experts.

Design: Cross-linking of datasets of most highly visible COVID-19 media experts with citation data on the impact of their published work (career-long publication record and COVID-19-specific work).

Setting: Cable news appearance in primetime programming or overall media appearances.

Participants: Most highly visible COVID-19 media experts in US, Switzerland, Greece, and Denmark

Interventions: none

Outcome measures: Citation data from Scopus along with discipline-specific ranks of overall career-long and COVID-19-specific impact based on a previously validated composite citation indicator.

Results: We assessed 76 COVID-19 experts who were highly visible in US primetime cable news, and 50, 12, and 2 highly visible experts in media in Denmark, Greece, and Switzerland, respectively. Of those, 23/76, 10/50, 2/12, and 0/2 were among the top-2% of overall citation impact among scientists in the same discipline worldwide. Moreover, 37/76, 15/50, 7/12, and 2/2 had published anything on COVID-19 that was indexed in Scopus as of August 30, 2021. Only 18/76, 6/50, 2/12, and 0/2 of the highly visible COVID-19 media experts were women. 55 scientists in the USA, 5 in Denmark, 64 in Greece, and 56 in Switzerland had a higher citation impact for their COVID-19 work than any of the evaluated highly visible media COVID-19 experts in the respective country; 10/55, 2/5, 22/64, and 14/56 of them were women.

Conclusions: Despite notable exceptions, there is a worrisome disconnect between COVID-19 claimed media expertise and scholarship. Highly-cited women COVID-19 experts are rarely included among highly visible media experts.

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ARTICLE SUMMARY

Strengths and limitations of this study

- We examined the citation impact in the scientific literature of highly visible COVID-19 media experts in four different countries (USA, Denmark, Greece, and Switzerland)

- We also examined whether these highly visible media experts had published anything on COVID-19

- We identified women experts who have contributed with high impact in the COVID-19 literature but have not been among these highly visible media experts

- The findings need to be extrapolated cautiously in other countries and other media (e.g. social media)

- Most scientists may not wish to be visible in media, but the disconnect between COVID-19 claimed media expertise and scholarship is worrisome.

INTRODUCTION

The COVID-19 pandemic has been accompanied by an unprecedented infodemic in the news and social media.[1,2] Media coverage has been intensive, continuous, massive, and heated and has involved a very large number of alleged experts. The involvement of knowledgeable scholars in the public discussion and dissemination of information on such a monumental crisis is clearly welcome and indispensable. However, how knowledgeable are the experts recruited by media?

Knowledge and expertise are difficult to appraise with full objectivity. Bruce Weinstein[3] argued that there are two kinds of experts, those who are recognized as experts based on what they know (epistemic expertise) and those who are worthy of being called experts based on what they do (performative expertise). According to this classification, an epistemic expert is a person who is capable of providing strong justification for a range of claims in a domain, while performative expertise characterizes a person who is able to perform a skill well according to the rules and virtues of a practice.[3] Performative experts may not necessarily be contributors to the scientific literature themselves, but may still know their job well and have extensive practical experience. It is very difficult, however, to appraise in a standardized manner and with consistency and quantitative metrics such performative expertise. Conversely, epistemic experts are likely to be contributors to the scientific literature and their level of contribution and impact in the science of their field is a key hallmark of their expertise. What can be readily appraised in a non-subjective fashion is the publication and citation track record of scientists who appear in news media as experts. One can use objective data to quantify the citation impact of the published work of these scientists across science throughout their career, as well as the specific impact that they are having with their scientific publications about COVID-19. While publications and citations do have limitations) as all bibliometric metrics), they are objective, readily quantifiable and offer useful information about scientific impact. Here we aimed to evaluate the overall and COVID-19 specific citation impact of the most highly

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visible COVID-19 experts in USA, Denmark, Greece, and Switzerland. We also paid particular attention to

probing the representation of women among highly visible COVID-19 experts, as it has been previously

suggested that women are under-represented among COVID-19 experts in the USA.[4]

METHODS

Highly visible media COVID-19 experts

We examined bibliometric indicators of top media experts in USA, Switzerland, Greece, and

Denmark. These are countries for which we could identify pre-existing lists of experts who had prominent

visibility in media. These lists are typically not published in the peer-reviewed scientific literature (with the

exception of the USA list that was previously generated and published by members of our team),[4] but in

media news items in different countries, thus defying the possibility for efficient systematic searches. We

therefore asked our colleagues at the Meta-Research Innovation Center at Stanford (METRICS) and

affiliated colleagues who come from different countries if they were aware of any such publicized lists. We

accepted these lists regardless of how visibility had been defined in these surveys.

For the USA, we examined the scientific citation impact of all scientists who had appeared between

May 18 to June 19, 2020 during primetime programming on 3 popular American cable news networks: Fox

News Network, CNN, and MSNBC. Details on the data collection and selection for the USA list and

features of the sample have been previously described.[4] Of the 220 people who appeared during these

programs, 76 were scientists (47 physicians and 29 PhDs).

For European countries, searches for visible experts were made by local organizations in each

country and they pertain to national media visibility. For Denmark, we found a news article that listed the

50 experts who had the highest number of appearances in media during 2020 (television, radio,

newspapers).[5] For Greece, we found a news article that listed the 12 COVID-19 experts who had the

highest television exposure based on measured time of television appearances.[6] For Switzerland, the Swiss

Media Database (SMD) captures appearances in media in Switzerland. We could find information from a

news article[7] on the two most commonly appearing names of COVID-19 experts in SMD between md-

January and June 2020.

Citation databases for overall impact of scientific work and COVID-19-specific work

For overall (career-long) impact of scientific work, we used a previously developed, publicly

available dataset[8] that includes the top 2% of scientists across each of the 174 disciplines of science

(classified according to the Science Metrix classification).[8] All ~8 million scientists who have published at

least 5 Scopus-indexed full papers (counting articles, reviews, and conference papers) are considered. The

ranking uses a previously developed and validated composite citation indicator[9] that merges 6 citation

metrics (total citations, Hirsch h index, co-authorship-adjusted Schreiber Hm index, citations to single-

authored papers, citations to first- or single-authored papers, and citations to single-, first- or last-authored

papers).

We also examined which of the evaluated highly visible COVID-19 experts had published anything

pertaining to COVID-19 in the scientific literature. We used a previously created database[10] that includes

all the authors with at least 5 Scopus-indexed full papers in their career (on any topic) who had also

published at least one Scopus-indexed item on COVID-19 (peer-reviewed or preprint) as of March 1, 2021.

Details on the search strategy and retrieval of authors can be found in the paper describing the compilation

of that database.[10] In brief, the search string was: TITLE-ABS-KEY(sars-cov-2 OR "coronavirus 2" OR

"corona virus 2" OR covid-19 OR {novel coronavirus} OR {novel corona virus} OR 2019-ncov OR covid

OR covid19 OR ncovid-19 OR "coronavirus disease 2019" OR "corona virus disease 2019" OR corona-19

OR SARS-nCoV OR ncov-2019) with items limited to a publication date in 2020 or 2021. We have

previously[10] generated the same composite citation indicator (that includes the 6 citation metrics described

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above) limited to the citation impact of COVID-19 publications for each author as of March 1, 2021. We therefore noted how many of the highly visible COVID-19 experts were among the top-2000 or top-10000 ranked scientists for the citation impact of their COVID-19 publications as of March 1, 2021. We also updated the searches on August 30, 2021 to see how many of the experts had published any COVID-19-related paper by then.

We tabulated the experts who are in the top-2% of citation impact for their career-long published work and concurrently are among the top-2% based on the citation impact of their COVID-19 published work in their primary scientific disciplines among other scientists with the same primary scientific discipline.

We also noted how many of the highly visible media COVID-19 experts were women in each country; how many scientists in each country had a higher citation impact for their COVID-19 published work than all the highly visible media COVID-19 experts in the respective country; and how many of these scientists with higher citation impact for their COVID-19 published work were women.

All citation metrics and rankings thereof exclude all self-citations.

RESULTS

Experts in the USA

Of the 76 highly visible cable news COVID-19 expert scientists, only 18 were women. Only 23 of the 76 were in the top 2% of their main scientific discipline in terms of their citation impact during their careers until the end of 2019. The main disciplines of these 23 top-cited experts' previous scientific work was General and Internal Medicine (n=7), Economics (n=2), Health Policy and Services (n=2), Microbiology (n=2), Public Health (n=2), and 8 other disciplines (1 each). 13 appeared on MSNBC, 9 on CNN, and 1 on Fox News. Only 3 of the 23 were women.

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Only 37 of the 76 COVID-19 scientists had published anything that was COVID-19-related by August 30, 2021, more than a year months after they appeared as COVID-19 experts in these major media. Using the same composite citation indicator focused specifically on the citation impact of their COVID-19 work, only 7 were among the top-2000 scientists world-wide for COVID-19-related citation impact and 18 were among the top-10000 scientists worldwide in this regard. 19 appeared on MSNBC, 13 on CNN, and 2 on Fox News. Nine of the 34 were women.

Experts in Denmark

For Denmark, only 6 of the 50 top media experts were women. The most frequently appearing expert was Søren Brostrøm, director of the National Board of Health (9324 mentions, about 25 per day). 48/50 were Danes and 2 were foreigners. 43/50 had commented on COVID-19, but it was not stated who are the 7 who only commented only on other, non-COVID-19-related topics. Ten of the 50 (9 Danes, 1 foreigner) were among the 2% top-cited for career-long scientific work. A perusal of their listed scientific subfield suggested that 33/50 worked in a biomedical or potentially related field; thus, apparently, at least 10 of the experts were from other fields, which included economics or law. Among the 50, only 15 (all of them among the 33 biomedical) had published any COVID-19-related work indexed in Scopus by August 30, 2021. Only 3 were among the top-10000 scientists worldwide for COVID-19-related citation impact as of March 1, 2021 (Anthony Fauci, rank 224; Thomas Benfield, rank 4461; Lone Simonsen, rank 8307). Among the 48 visible experts who were Danes, the best ranked for published COVID-19 work (Thomas Benfield) was ranked 6th in COVID-19-related impact among scientists in Denmark.

Experts in Greece

For Greece, only 2 of the 12 most visible television COVID-19 experts were women. Ten of the twelve were local and two were in the diaspora (in UK and Switzerland) but appeared massively in Greek media. Two of the 12 (Elias Mossialos and Emmanouil Dermitzakis, both in the diaspora) were among the

2% top-cited for career-long scientific work. Only 7 of the 12 had published any COVID-19-related work indexed in Scopus by August 30, 2021. Only 1 was among the top-10000 scientists worldwide for COVID-19-related citation impact (Elias Mossialos, rank 4435). Among the 10 visible experts who were living in Greece, the best ranked for published COVID-19 work (Charalambos Gogos, worldwide rank 10710) was ranked 65th in COVID-19-related impact among scientists in Greece.

Experts in Switzerland

The two most commonly appearing names of COVID-19 experts in SMD between mid-January and early June 2020 were Marcel Salathé (École Polytechnique Fédérale de Lausanne), with 1400 entries in SMD during this period (as opposed to 9 entries in the entire 2019), and Christian Althaus (University of Bern) with approximately 700 entries. Neither of them have been in the top-2% of the most-cited scientists for their career work across all scientific topics. They have both published scientific work related to COVID-19. For their COVID-19-related published work, they are ranked 58th and 57th among scientists in Switzerland (rank 3839 and 3819, respectively, worldwide among all scientists publishing on COVID-19).

Top-cited on both on COVID-19 and during overall career

Based on our primetime US cable news sample, Table 1 shows the experts who were top-cited for their citation impact in the scientific literature during their overall career and also specifically for their work on COVID-19. Ezekiel Emanuel was the most highly-ranked (ranked 227th among over 495,000 scientists)[9] in global COVID-19 citation impact among our sample. There were 55 U.S. authors with higher COVID-19 citation impact. Among those 55, some such as Bill Gates (global COVID-19 citation ranking 212th) and Anthony Fauci (global COVID-19 citation ranking 224th) have attracted substantial media attention but simply did not appear in our primetime programming sample. E.g. there were numerous video clippings and references to Dr. Fauci that aired on the primetime programs that we screened, but he was not personally interviewed in the 5 weeks studied here. However, it is likely that the majority of the most

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influential scientists on COVID-19 research have not appeared prominently in the lay media and many of

them are probably entirely absent.

Our samples of massively visible experts from Switzerland and Greece were small, but only 1/12

visible experts (Elias Mossialos) was in the top-2% of both overall career-long and COVID-19 specific

citation impact. For the Denmark sample, only Anthony Fauci (and no local Danish scientists) were in the

top-2% of both COVID-19 and overall career-long citation impact.

Missing expert women with top citation impact

Among the 55 U.S. authors with higher COVID-19 citation impact than all the 76 scientists in our

US cable news sample, there were 10 women. They are shown along with their affiliations and their

primary and secondary disciplines of expertise in Table 2. We searched the CNN site

(https://www.cnn.com/search?size=10&q=), and the Fox News site (https://www.foxnews.com/#) for

videos in 2020 or 2021 up to March 14, 2021 (we found no way to search only for videos in MSNBC), i.e.

covering the entire period of the pandemic and all time slots, not just primetime. We found no stored

videos with the name of any of these 10 female scientists, as compared with 272 and 32400 videos,

respectively, retrieved with a search for "Fauci."

In Denmark, Greece, and Switzerland, 2/5, 22/64, and 14/56 scientists with higher COVID-19

citation impact ranking than the highest ranked massively visible news experts were women. These highly-

cited women scientists are shown along with their affiliations and their primary and secondary disciplines

of expertise in Table 3 for Denmark and Greece. For Switzerland where we only had the 2 most visible

COVID-19 experts, we could not exclude that several of the 56 scientists with higher COVID-19 citation

impact ranking may also had been highly visible in the media.

DISCUSSION

The present analysis suggests that only a minority of media-visible COVID-19 experts have had major scientific citation impact in their careers. Moreover, only a minority have any scientific record of any COVID-19-related publications. Highly visible COVID-19 media experts are very rarely influential in the scientific literature overall and/or in the COVID-19 scientific literature in particular. Women are markedly under-represented among those visible experts, although additional female experts exist. The under-representation of women in our examined samples was more prominent than what Fletcher et al. found by analyzing articles in 10 US newspapers in April 2020 where 34% of the authors were women.[11] We could not assess the racial background of media experts, but we suspect that minorities would also be under-represented, as they are under-represented in many aspects of both academics and societal power structures.[12,13]

One other recent study has examined the scientific productivity of COVID-19 experts.[14] Murayama et al. assessed the 11 most frequently appearing medical experts in Japanese television during the first 6 months of 2020, 10 of which were men. They found that only one of the 11 experts had published a single scientific paper on COVID-19 indexed in PubMed as of August 14, 2020. The very low rate of publishing experts in this Japanese sample may be due to the fact that the search date for publications was too early. It is possible that some experts may publish COVID-19-related papers later and the same applies also to experts without COVID-19-related publications in our evaluation. Indeed, on August 30, 2021 we re-examined the publication record of the 11 Japanese experts and found that 5 (45%) had published at least one Scopus-indexed COVID-19-related paper until that time. By analyzing data on payments from the pharmaceutical industry made in 2017, Murayama et al. also found that 7 of the 11 experts had received payments from the pharmaceutical industry amounting to $317,324 for that single year. We did not assess potential financial conflicts in our study. However, certainly this is an important issue for all countries and

it may often be difficult to ascertain in the absence of comprehensive payment databases that cover all potential financial conflicts for all scientists, not just clinicians.

The lack of sufficient representation of top scientists among the most visible experts in media may not be specific to COVID-19 and may affect all topics where science is invoked in public discourse. A pre-printed analysis of experts in German media (no individual names were available) suggested that media coverage on the COVID-19 pandemic actually used experts with higher citation indicators compared to earlier pandemics.[15] Past empirical evaluations of experts on various topics has shown that many of them, typically the majority, have not done any research themselves on the topics on which they pontificate.[16-18] Concurrently, there is an increasing hunger for having more and more experts in popular media.[19,20]

The best or the most-cited scientists should not necessarily be the ones who appear the most frequently in media. Some of the experts whom we analyzed have accumulated a track record of massive media engagements that require an enormous commitment of time and psyche. Many highly competitive, excellent scientists would find it difficult or even impossible to pursue their scholarly work and have an intense media presence at the same time. Moreover, especially for COVID-19, polarization, politics, and an environment of conspiracy, mistrust, and public unrest and rage may have disincentivized many leading scientists from engaging with media. Women and minorities may feel even more disincentivized in this environment.

Nevertheless, communication with the wider public is an important mission of science, medicine, and public health. Information on COVID-19 in media has been shown to be of questionable quality.[1,2] Its quantity is clearly immense. The vast majority is produced and disseminated by people without any scientific training and with little or no self-reflection on their inadequacy to judge complex and rapidly

evolving scientific concepts. It may be impossible to diminish the bulk of information, but at a minimum its quality should be improved. Engaging qualified experts may be critical in this regard.

Empirical studies show that non-experts are very poor at making predictions about COVID-19, and they are worse than experts – even though even experts do not account sufficiently for uncertainty in their estimates and are therefore often also wrong.[21] Both models and empirical data suggest that media can have an impact on the course of the pandemic[22] and it can also affect mental health during its course.[23] While there can be questions and concerns even about the media appearances of the best and most knowledgeable experts, media without involvement of scientific expertise is likely to be far worse.[24,25]

Of note, several of the highly visible media COVID-19 experts were probably invited in some capacity other than their research scholarship, e.g. some scientists had political or administrative roles and others were front line clinicians rather than academics. These aspects of non-research expertise are also very useful, and it could well be that all experts analyzed here should be applauded for their willingness to engage and inform the wider public. Even if they lack focused research expertise on COVID-19, certainly many practicing physicians and scientists may still elevate the discourse compared with people without any medical and scientific training. However, it is worrisome that "scientific experts" in the news include so few of the scientists who have themselves made substantial scholarly contributions.

The current study has used diverse data from several countries for experts who are highly visible in media and has linked their profiles to objective data from bibliometric analyses. While methods for selecting experts are different in each country, the observed patterns seem to be consistent across countries. However, there are also several limitations that need to be discussed.

First, we should acknowledge that citation metrics are far from being perfect measures of epistemic expertise. Moreover, we focused on using already existing data on the 2% top-cited scientists across each scientific discipline, and we could not examine whether scientists who were not in the top 2% of these pre-

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existing lists might be in the top-3% or in the bottom 5% of citation impact. Obviously, many scientists may still have considerable epistemic expertise even if they are not strictly in the top 2% of citation indicators.

Second, our examined lists of media visible experts were pre-compiled independently of the current analysis. The pre-compilation had happened either by our team (in the case of USA experts) or by news and media organizations in different countries and these compilations may use different criteria for identifying and ranking experts for visibility. It is possible that some different names might have entered these lists, if different visibility criteria had been used. Nevertheless, all of the experts analyzed here had prominent media exposure and all analyzed experts in European countries had massive media exposure in order to be able to reach such high ranks of visibility (even if variously defined).

We encourage media to look more carefully at the diversity and scholarly qualifications of the experts they invite, even more so for experts that have massive media appearances. Special attention should be given to inviting women, and our evaluation offers examples of many women scientists who might be considered in this regard. We suspect that many top experts may still wish to avoid media exposure and this should be respected. However, transparency and availability of opportunity are still important to ensure.

Author contributions: John Ioannidis had the original idea and wrote the first draft. John Ioannidis, Alangoya Tezel and Reshma Jagsi brainstormed on the topic and revised the manuscript. John Ioannidis, Alangoya Tezel and Reshma Jagsi approved the final paper. John Ioannidis is guarantor.

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Data sharing: all the data are in the manuscript and tables and additional detail on citation data in available in publicly deposited datasets in Mendeley.

Competing interests:

We have read and understood BMJ policy on declaration of interests and have no relevant interests to declare. JPAI has given some COVID-19 media interviews (a hundred fold less compared with some of the listed experts) that have resulted in smearing, hate e-mails, threats, censoring, hostile behavior, harassment, and a life-threatening experience for a family member. He is among the top-cited scientists in both the overall and COVID-19-specific citation databases used in the presented analyses. In his Stanford webpage, he admits that despite being "among the 10 scientists worldwide who are currently the most commonly cited); when contrasted against my vast ignorance, these values offer excellent proof that citation metrics can be horribly unreliable." RJ is also listed among the top-cited scientists in the overall citation database.

LICENCE

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Table 1. Some outstanding scientists with media presence (those of the 76 with primetime appearance in

CNN, MSNBC or Fox News in May 18 to June 19, 2020 who are at the top-2% of citation impact in their

discipline both for all their work and for their COVID-19 work)

Name	Institution	Primary discipline	Rank for COVID-19	Scientists in discipline (COVID-19 work)	Rank for all work	Scientists in discipline (all)
Grabowski, David C.	Harvard Medical School	Health Policy & Services	1	2522	90	16521
Holtgrave, David R.	University at Albany	Public Health	48	9211	385	48533
Jha, Ashish K.	Harvard University	General & Internal Medicine	397	32920	91	106795
Gawande, Atul A.	Brigham and Women's Hospital	Surgery	114	12295	58	80940
Topol, Eric	Scripps Research Translational Institute	Cardiovascular System & Hematology	28	19231	7	152312
Emanuel, Ezekiel J.	University of Pennsylvania Perelman School of Medicine	General & Internal Medicine	26	32920	31	106795
Fineberg, Harvey V.	Gordon E. and Betty I. Moore Foundation	General & Internal Medicine	158	32920	503	106795

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Risch, Harvey A.	Yale University	Oncology & Carcinogenesis	95	19550	690	230678
Hotez, Peter J.	Baylor College of Medicine	Tropical Medicine	8	4941	4	28529
Prather, Kimberly A.	Scripps Institution of Oceanography	Meteorology & Atmospheric Sciences	8	1745	830	54940
Aral, Sinan	MIT Sloan School of Management	Information Systems	91	619	163	16581

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Table 2. Women scientists with higher citation impact of their COVID-19-related published work than all of the 76 experts who appeared in the analyzed sample of USA cable news primetime

Scientist	Institution	Primary discipline	Secondary discipline
Guarner, Jeannette	Emory University School of Medicine	Pathology	Microbiology
Bourouiba, Lydia	Massachusetts Institute of Technology	Fluids & Plasmas	Evolutionary Biology
Phelan, Alexandra L.	Georgetown Law	General & Internal Medicine	Applied Ethics
Abbasi, Jennifer	University of California, San Francisco	General & Internal Medicine	
Walls, Alexandra C.	University of Washington, Seattle	Developmental Biology	Biophysics
Connors, Jean M.	Harvard Medical School	Cardiovascular System & Hematology	Immunology
de Wit, Emmie	NIAID Rocky Mountain Laboratories	Virology	Microbiology
Volkow, Nora D.	National Institutes of Health (NIH)	Neurology & Neurosurgery	Psychiatry
Rubin, Rita	Independent journalist	General & Internal Medicine	
Amanat, Fatima	Icahn School of Medicine at Mount Sinai	Microbiology	Virology

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Table 3. Women scientists with higher citation impact of their COVID-19-related published work than all

of the 50 most visible media experts in Denmark; or than all the 12 most visible television COVID-19

experts in Greece

Scientist	Institution	Primary discipline	Secondary discipline
Vindegaard, Nina	Copenhagen University Hospital	Neurology & Neurosurgery	Psychiatry
Olsen, Sonja J.	WHO Regional Office for Europe	Microbiology	Virology
Anastassopoulou, Cleo	National and Kapodistrian University of Athens	Virology	Epidemiology
Fragkou, Paraskevi C.	Attikon University Hospital	Microbiology	Emergency & Critical Care Medicine
Goumenou, Marina	University of Crete Medical School	Food Science	Toxicology
Psaltopoulou, Theodora	National and Kapodistrian University of Athens	Oncology & Carcinogenesis	Nutrition & Dietetics
Rovina, Nikoletta	National and Kapodistrian University of Athens	Respiratory System	Immunology
Maltezou, H. C.	National Public Health Organization	Microbiology	Virology
Gavriilaki, Eleni	George Papanicolaou General Hospital	Cardiovascular System & Hematology	Immunology
Parlapani, Eleni	Aristotle University of Thessaloniki	Psychiatry	Substance Abuse
Katsaounou, Paraskevi	National and Kapodistrian University of Athens	Public Health	Respiratory System
Gavriatopoulou, Maria	National and Kapodistrian University of Athens	Immunology	Oncology & Carcinogenesis
Dalamaga, Maria	National and Kapodistrian University of Athens	Endocrinology & Metabolism	Dermatology & Venereal Diseases

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Kaparounaki, Chrysi K.	Aristotle University of Thessaloniki	Psychiatry	
Koutsoukou, Antonia	National and Kapodistrian University of Athens	Respiratory System	Emergency & Critical Care Medicine
Nikitara, Katerina	University of Crete Medical School	Public Health	Toxicology
Rizou, Myrto	Galanakis Laboratories	Obstetrics & Reproductive Medicine	Food Science
Kotanidou, Anastasia	National and Kapodistrian University of Athens	Emergency & Critical Care Medicine	Respiratory System
Kontou, Panagiota	Panepistimio Thesalias	Bioinformatics	Genetics & Heredity
Akinosoglou, Karolina	University of Patras, School of Medicine	Microbiology	Immunology
Dedeilia, Aikaterini	National and Kapodistrian University of Athens	General & Internal Medicine	Oncology & Carcinogenesis
Georgakopoulou, Eleni A.	National and Kapodistrian University of Athens	Dentistry	Dermatology & Venereal Diseases
Mpesiana, Tzani A.	Panepistimion Patron		
Katsiki, Niki	Aristotle University of Thessaloniki	Cardiovascular System & Hematology	Medicinal & Biomolecular Chemistry

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